SSVEO IFA List **Date:02/27/2003**

STS - 38, OV - 104, Atlantis (7) **Time:04:18:PM**

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-38-V-01	HYD
MMACS-01	GMT:		SPR 38RF01	UA	Manager:
			IPR	PR	
					Engineer:

Title: Water Spary Boiler (WSB) 2 Controller A not Cooling (ORB)

Summary: DISCUSSION: WSB 2A failed to cool the Auxiliary Power Unit (APU) lube oil after the pool boiling period during ascent. The WSB was switched to the B controller and APU 2 was left on after APU 1 and 3 were shut down to verify WSB operation. Effective lube oil cooling was seen 1 minute 6 seconds after switching to the B controller.

The most probable cause of this problem was spray bar freeze up. Spray bar freeze up probably occurred as a result of lube oil wax contamination within the WSB tube bundle which reduced the heat transfer capability of the system. Hydrazine contamination of lube oil produces wax, with a melting point of 120 deg. F to 180 deg. F, and Pentaerythritol, a crystal, with a melting point of approximately 500 deg. F. This wax must pass through a tube bundle comprised of 103 crimped tubes of 0.06 inch inner diameter and 81 smooth tubes with 0.1 inch inner diameter. Because of the small diameters of the tubing, the contamination can easily block the WSB tube bundle and significantly reduce the heat transfer capability of the WSB. This particular WSB is the same boiler (S/N 02) which saw spray bar freezing during STS-1 through STS-4. WSB spray bar freeze ups were virtually eliminated after STS-6 with a new, smaller orifice. Freezing was not evident between STS-6 and STS-27R and there was no evidence of wax in the gearbox during STS-27R through STS-36. CONCLUSION: The WSB tube bundle is believed to be contaminated with Hydrazine, producing a wax/crystal contaminate which reduced the heat transfer capability of the WSB. The reduced heat transfer resulted in less heat being radiated to the spray bar for thawing and more residual water remaining at the end of the pool boil period. At SSME cutoff the residual water in the WSB froze up the spray bar. The time lag associated with analyzing the problem and then switching to the B controller allowed the spray bar to thaw and the system to begin spraying. The boiler freeze up is not a pre-MECO or entry concern. However, it is a potential abort concern. Freeze up may result in APU shutdown due to overtemp and/or a hot restart depending on the required thaw time. Preliminary analysis for the worst case thaw time is approximately 8 minutes. The accumulation of wax/crystal deposits in the WSB's can lead to performance degradation with time. This accumulative effect can increase the potential of 2 or more boilers seeing an inflight anomaly during the same flight. CORRECTIVE_ACTION: The WSB was removed and replaced. A hot oil flush was performed on all three systems in an attempt to remove any accumulation of contaminants. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:02:11	Problem	**FIAR**	**IFA** STS-38-V-02	Active Thermal Control
EECOM-01	**GMT:** 320:02:00		**SPR** 38RF02	**UA**	Subsytem
			IPR	**PR** ECL 4-08-0462	**Manager:**
					Engineer:

Title: Flash Evaporator System (FES) Water Supply Accumulator Heater System Biased Low. (ORB)

Summary: DISCUSSION: Early in the mission, the FES water supply accumulator heater system 1 failed to cycle on within its prescribed range of 55-75 degrees F. When the temperature reached 49 degrees, heater system 2 was activated. System 2 subsequently displayed normal duty cycles, but within a lower than normal range (from 48-54 degrees F).

CONCLUSION: The most likely cause of the problem was a debonded temperature sensor (V63T1760A), which was discovered postflight. CORRECTIVE_ACTION: The debonded temperature sensor has been rebonded. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:07:16	Problem	**FIAR**	**IFA** STS-38-V-03	PRSD,APU,EPD&C
EGIL-02, EGIL-03	**GMT:** 320:07:05		**SPR** A) 38RF03; B)	**UA**	**Manager:**
			38RF04; C) 38RF07	**PR** A) FCP 4-08-0124; B)	
			IPR	APU 4-08-0223; C) EPD 4-	**Engineer:**
				08-08	

Title: Operational Instrumentation Failures. (ORB)

Summary: DISCUSSION: A. At around 12 hours MET, the PRSD H2 Tank 3 Quantity Transducer (V45Q2305A) went from 97% to off-scale during a lost of signal (LOS) period. The crew verified the panel meter also read off-scale. This is indicative of a failed signal conditioner, a criticality 3/3 failure mode. The failed signal conditioner was removed and replaced and is being tested at the vendor. This problem is closed, and is tracked by CAR 38RF03-010.

B. The Auxiliary Power Unit (APU) 3 (ser. no. 311) X-axis accelerometer measurement (V46D0380A) became erratic during entry. This is a criticality 3/3 failure mode. The measurement's signature indicated a problem either with a cable or the Wide Band Signal Conditioner (WBSC). The WBSC calibration was verified postflight. Additional troubleshooting revealed a bad coaxial cable on the Orbiter that probably caused this problem. The cable was replaced and subsequent testing verified that the sensor worked properly, indicating that the cause of the problem was indeed the bad cable. This problem is now closed. This problem is being tracked by CAR 38RF04.

C. One minute prior to touchdown, the Main Bus A (MN A) Mid-Power Controller 1 (MPC1) current (V76C3085A) dropped to zero. No change in FC1 current was detected, and the operational statistics (OPS STATS) did not go to zero, which indicates that the current sensor failed. This is a criticality 3/3 failure mode. The current sensor will be removed and replaced. This problem is closed and is being tracked by CAR 38RF07. CONCLUSION: See above. CORRECTIVE_ACTION: See above. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 001:02:40	Problem	**FIAR** A) BFCE-213-F005; B) BFCE-029-F020; C) BFCE-029-F0	**IFA** STS-38-V-04	CCTV
MMACS-05; INCO-04; INCO-01; INCO-02	**GMT:** 321:02:29			**UA**	**Manager:**
				PR A) EPD-4-08-0184; B) COM-4-08-0094	
			SPR None		**Engineer:**
			IPR C) NONE; D) 37V-0024		

Title: GFE: a) Vacuum Cleaner Short Circuit b) Closed Circuit Television Monitor 2 Fault Light On c) Closed Circuit Television Camera C Failed to Focus d) Closed Circuit Television Camera D No Power (GFE)

Summary: DISCUSSION: a) When the crew turned on the vacuum cleaner at approximately 321:02:29 G.m.t., circuit breaker 29 on panel L4 opened because of a current surge. The vacuum cleaner was stowed for the remainder of the flight and the crew was directed to discontinue use of utility outlet M013Q into which the vacuum cleaner was plugged. Postflight troubleshooting detected that the vacuum has a short from phase B to the chassis ground. Outlet M013Q was tested per OMRSD requirement V76A20.030-B and no damage to the outlet was noted.

b) At 321:19:52 G.m.t., the crew reported that the fault light was lit on closed circuit television (CCTV) monitor 2. They performed their malfunction procedure which verified that the fault light was a real fault indication caused by an overcurrent in the low voltage power supply. Subsequent attempts by the crew to repower monitor 2 were also unsuccessful. CCTV monitor 1 was used for the remainder of the mission. Monitor 2 was tested on the Orbiter at KSC after the mission and the inflight results were verified. c) At 320:03:51 G.m.t., the crew reported that they could not sharply focus CCTV camera C and that it was unusable for further operations. At approximately 320:22:30, the CCTV system was repowered and the crew reported that camera C was focusing correctly. Camera C focused correctly for the remainder of the mission. After the flight, camera C was removed and sent to the flight equipment processing contractor (FEPC) for evaluation. Preinstallation acceptance (PIA) tests were conducted on the lens and on the combined lens and camera body with no anomalies noted. The lens focusing mechanism was then cycled an additional 10 times and performed flawlessly. d) At 320:03:51 G.m.t., the crew reported that they had no indication of power to CCTV camera D. No lights for automatic light control (ALC) or gamma were noted. At 320:22:30, the CCTV system was repowered and Camera D functioned normally. Camera D remained functional for the remainder of the flight. During debriefing, the crew reported that they had left the camera D circuit breaker (cb51) out at initial power up, but even when they closed the circuit breaker, camera D did not power on. They also mentioned that a similar transient camera D power problem had happened during the crew equipment interface test prior to launch. After the

flight, KSC performed ten camera D power cycles on the Orbiter with both the camera D switch and circuit breaker being cycled but could not duplicate the failure to power on. Camera D was removed and replaced and the removed unit was sent to FEPC for further troubleshooting. FEPC conducted two PIA tests on camera D and cycled power on the camera 20 times with no anomalies noted. CONCLUSION: a) The vacuum cleaner experienced a short circuit between phase B and the chassis ground. Failure analysis is in progress to determine the exact cause of the short. b) The CCTV monitor 2 experienced an overcurrent in the low voltage power supply. c) The CCTV camera C failure to focus was transient and the cause of the problem is unexplained. d) The CCTV camera D failure to power on was transient and the cause of the problem is unexplained. CORRECTIVE_ACTION: a) The STS-38 vacuum cleaner has been removed from the inventory. The motor from this unit is undergoing failure analysis at the manufacturer, IMC Magnetics. Preflight testing of the vacuum cleaners in inventory has been modified to include a chassis ground test that will screen out any future occurrences of this problem. b) The CCTV monitor 2 was removed and replaced. The removed unit has been sent to the vendor for failure analysis and repair under the listed FIAR. c) The CCTV camera C was removed and replaced on OV-104. The replaced camera will be verified by the OMRSD retest requirements. If this problem recurs on a future flight, it appears to be transient, and even if the problem recurs and persists, redundancy exists in the CCTV camera system. d) The CCTV camera D was removed and replaced on OV-104. The replaced camera will be verified by the OMRSD retest requirements. The removed camera will be returned to the inventory. If this problem recurs on a future flight, it appears to be transient, and even if the problem recurs and persists, redundancy exists in the CCTV camera system. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 001:23:59	Problem	**FIAR**	**IFA** STS-38-V-05	APU
MMACS-02, MMACS-	**GMT:** 321:23:48		**SPR** 38RF05	**UA**	**Manager:**
03,MMACS-04, MMACS-			**IPR** 37V-0008; 37V-0007	**PR**	
06					**Engineer:**

Title: Auxiliary Power Unit (APU) Instrumentation Interaction (ORB)

Summary: DISCUSSION: APU 2 Exhausd Gas Temperature (EGT) measurements 1 (V46T0242A) & 2 (V46T0240A) and APU 2 and APU 3 Injector Tube Temperatures (V46T0274A and V46T0374A respectively) became erratic during launch.

CONCLUSION: The EGT thermocouple lead apparently shorted to the orbiter structure, inducing a ground loop current that affected the Injector Tube Temperature measurements. It should be noted that this particular failure is a unique condition - the typical failure scenario is for the EGT to fail open which results in an off-scale low condition. The two EGT measurements are redundant only to each other and provide the only indication of the actual temperature inside the exhaust duct. If both EGT sensors fail, an exhaust duct integrity check would be performed postflight to determine any possible degradations. The injector tube temperature measurement is required only to verify cooling for hot restart contingencies. If this measurement was lost, injector cooling water flow could be verified by monitoring the injector cooling water tank for a pressure decay or by monitoring the gas generator bed temperature for a possible decrease (if the bed temperature is below 500 F). This anomalous condition presented no impact to either flight safety or mission success. CORRECTIVE_ACTION: The EGT sensors have been removed and replaced. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 004:22:17	Problem	**FIAR**	**IFA** STS-38-V-06	MECH
MMACS-09	**GMT:** 324:22:06		**SPR** 38RF06	**UA**	**Manager:**
			IPR	**PR** STR-2-11-2705	
					Engineer:

Title: Right Vent Door 1, 2 Purge Position Failure. (RMS)

Summary: DISCUSSION: During the postlanding vent door purge positioning operation, the right vent doors 1 and 2 drove to the closed position. This failure did not impact the ability to purge either the plenum or the forward RCS module.

CONCLUSION: During KSC troubleshooting the failure was isolated to the purge position limit switch. Both vent doors are attached to a single actuator. The actuator is driven by two motors, either one of which can drive the doors to the commanded position. The motor that utilized the failed limit switch did not stop at the purge position but continued to drive the door closed. CORRECTIVE_ACTION: The actuator was removed and replaced and sent to Rockwell Service Center for the tear down analysis. EFFECTS_ON_SUBSEQUENT_MISSIONS: None. Redundant vent doors exist for each cavity. The worst case failure of a vent door would be a failure to close for entry (requires two failures), introducing excessive heat into the vent box. Analysis indicates that if this failure occurs it would result in some damage to the vent box only, but no damage to the surrounding structure.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 004:20:08	Problem	**FIAR**	**IFA** STS-38-V-07	OMS/RCS
PROP-01	**GMT:** 324:19:57		**SPR** 38RF08	**UA**	**Manager:**
			IPR 37V-0013; 39V-0093	**PR**	
					Engineer:

Title: RCS Primary Thruster R1U Low Chamber Pressure (ORB)

Summary: DISCUSSION: During the last day of the mission, the Reaction Control Subsystem (RCS) R1U chamber pressure was 20 to 25 psi lower than the nominal 150 psia. Thrusters R4U, R3D, R3R, and F3L also had several low chamber pressure indications, but all recovered prior to the deorbit burn. All thrusters were in minimum pulse mode when the low chamber pressures occurred. The thruster was reprioritized for entry.

Seven possible causes were considered: The first possible cause was a chamber pressure transducer bias, but the chamber pressure transducer passed a nine-point calibration at KSC and also indicated normal pressures during postflight turnaround activities. The second possible cause was a cracked chamber pressure tube or injector face, but the thruster passed a pressure decay test and helium mass spectrometer check out during postflight turnaround activities. The third possible cause was a blocked

chamber pressure tube or injector doublets, but during postflight turnaround activities, KSC inspected the thruster with a flashlight and mirror as well as with a borescope and nothing unusual was detected. The fourth possible cause was helium ingestion cushioning the valve response, but no evidence exists in the data of earlier gas ingestion, and no loading deviations occurred that could have trapped helium. The fifth possible cause was a low voltage supply or an associated reaction jet driver failure, but no abnormalities were found in the Orbiter voltage supply data. No history of reaction jet driver failures exists, and the data showed no anomalous behavior from other RCS hardware that shares the dedicated signal conditioners used by the R1U thruster. The sixth possible cause was a data sample error, but the data skew was insignificant. Additionally, even with minimum pulse mode pulses, the sample rate should have picked up the peak chamber pressure. The seventh possible cause was low manifold pressure or multiple thrusters firing, but the data shows that the manifold pressures were nominal. Also, the frequency of the thruster firings could not support such consistently low chamber pressures. Vehicle rates were also examined to verify that the R1U thruster was producing the proper thrust. No unexpected rates were observed; however, the smallest detectable rate change is about the same as the rate change a single thruster at minimum pulse length would impart, therefore, any rate data may be inconclusive. CONCLUSION: The most probable cause is trapped helium in a thruster valve, thus cushioning and slowing down valve response. No reasonable explanation could be found to explain this anomaly. There is no evidence of a hardware failure. CORRECTIVE_ACTION: None. Recommend fly as is based on redundancy. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 004:22:01	Problem	**FIAR**	**IFA** STS-38-V-08	MECH
MMACS-08	**GMT:** 324:21:50		**SPR** 38RF09	**UA**	**Manager:**
			IPR None	**PR**	
					Engineer:

Title: Continuous "Tire Press" Fault Detection and Annunciation Messages Postlanding (ORB)

Summary: DISCUSSION: Postlanding, after the crew reset the landing gear arm/down reset switch as part of the landing gear safing procedures, continuous "tire press" messages were annunciated by the BFS. These messages continued until the BFS was powered down.

When the three landing gear are armed, the BFS tire pressure FDA is inhibited. This disables the alarms that might otherwise occur at touchdown when the tire pressure strain gauge wires are detached. When the Landing Gear Arm/Down Reset switch is reset, the tire pressure FDA is re-enabled. Although the strain gauges are detached from the strain gauge signal conditioners (SGSC), the SGSC's still output an internal bias of 0.5 volt DC (VDC), to the MDM, which corresponds to 50 PCM counts. The tire pressure FDA lower limit is 50 counts. If the signal conditioner output bias drops below 0.5 VDC, due to line noise induced externally or SGSC bias drift, then a tire pressure FDA message will be annunciated. If the SGSC bias remains equal to or more than 0.5 VDC then no message will occur. In this case, line noise (caused by the disconnected lead from the strain gauges) caused the output of the SGSC to be erratic, tripping the FDA lower limit several times. CONCLUSION: The cause of the multiple "Tire Press" FDA messages was line noise generated by the disconnected leads from the tire pressure strain gauges. Line noise coupled with the SGSC bias of 0.5 VDC caused the output of SGSC to cycle above and below the BFS tire pressure FDA lower limit, tripping the alarm several times. The possibility of these messages is a known condition which is documented in BFS User Note DR: 101963. CORRECTIVE_ACTION: New tire pressure transducers will be installed on each vehicle

beginning with OV-103, STS-48, in October of this year. These transducers will have signal conditioners which will have no output bias (no bias will result in a single alarm for each tire when the LG Arm/Down Reset switch is reset). In addition, a software CR has been submitted (CR 90415) to keep the BFS tire pressure FDA disabled postlanding. EFFECTS_ON_SUBSEQUENT_MISSIONS: None. These are nuisance alarms which occur postlanding only.

Tracking No	**Time**	**Classification**	**Documentation**		**Subsystem**
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-38-V-09	Atmospheric
None	**GMT:**		**SPR** 38RF10	**UA**	Revitalization Subsytem
			IPR None	**PR**	**Manager:**
					Engineer:

Title: Smoke Detector Transient Event Indications During Mission (ORB)

Summary: DISCUSSION: During the STS-38 mission, transient alarm event indications were registered by 8 of the 9 smoke detectors. These transients can be caused by spurious voltage spikes which trigger the event indicators, but are not high enough to trigger the smoke alarm. No corresponding increases in smoke concentration were noted duirng any of these event indications.

A similar anomaly occurred on STS-32, in addition to several smoke alarms. These alarms and event indications are thought to be related. The STS-32 failure analysis is still in work. CONCLUSION: The cause of these transient alarms will be determined through failure analysis at the vendor. CORRECTIVE_ACTION: The cabin heat exchanger smoke detector has been removed and replaced and is undergoing failure analysis at the vendor (as part of the ongoing failure analysis on the STS-32 smoke detector). The spurious voltage spikes that triggered the event indications have been successfully duplicated as part of this analysis.
EFFECTS_ON_SUBSEQUENT_MISSIONS: None, pending failure analysis results.
